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HS-803-839

RFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES

Third Series - Report No. 10
1978 Honda, 98 CID (1.6 Liters)

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W.F. Marshall

U.S.DEPARTMENT OF ENERGY
BARTLESVILLE ENERGY TECHNOLOGY CENTER
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INTERIM REPORT

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Washington DC 20590

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16. Abstract

Experimental data were obtained in dynamometer tests of a 1978 Honda 98 CID engine engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine operating modes. The objective of the program is to obtain engine performance data for estimating emissions and fuel economy for varied engine service and duty. The intent of the work is to provide basic engine characteristic data required as input for engineering calculations involving ground transporatation.

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PREFACE

This report, prepared by the U.S. Department of Energy, Bartlesville Energy Technology Center, for the U.S. Department of Transportation, Transportation Systems Center, Energy Technology Branch, Cambridge MA, presents results of experimental work to obtain information on performance characteristics of an engine used in automobiles sold in the United States. The 1978 Honda 98 CID engine used in this work is one of a series of 15 engines to be tested in the current program. This is the tenth of the reports to be published covering work with those engines.

This project is funded by the National Highway Traffic Safety Administration, Office of Research and Development, Office of Passenger Vehicle Research, Technology Assessment Division.

James A. Kidd, Jr. and Ralph G. Colello of the U.S. Department of Transportation, Transportation Systems Center, are the technical monitors.

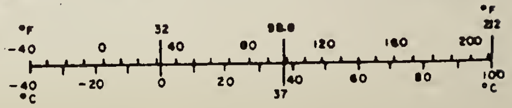
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



1. INTRODUCTION

The objective of this program is to obtain engine performance data for estimating fuel economy and emissions for varied engine service and duty. The intent of the work done at the Bartlesville Energy Technology Center is to provide basic engine characteristic data required as input for engineering calculations of fuel consumption and emissions involving ground transportation.

The data acquired from tests of a 1978 Honda 98 CID engine are presented in this report. Honda uses the 98 CID engine in the Accord. The Accord is in the 2,250 lb inertia weight class. The engine, as equipped, is intended for use in a forty-nine state (Federal) vehicle with automatic transmission. The test results are sufficient to establish steady-state maps for fuel consumption and emissions (carbon monoxide, unburned hydrocarbons, and oxides of nitrogen) over the entire operating range of the engine.

2. ENGINE TEST REPORT

The engine test setup included a complete mean tolerance engine (SAE definition) coupled to an eddy-current dynamometer. A cooling tower was used in place of the fan and radiator. The alternator was included but was not wired into the engine's electrical system. The emission control systems included positive crankcase ventilation and a charcoal canister for evaporative emissions. The manufacturer's specifications for the 1978 Honda CVCC (compound vortex controlled combustion) engine are given in Table 1.

Prior to testing, break-in consisted of 40 hours of operation at various speed/load modes representative of normal engine operation. Table 2 contains details of the break-in schedule. A single batch of unleaded regular grade gasoline was used throughout the break-in and test; a detailed fuel analysis is given in Table 3. Engine testing began on September 20, 1978, and ended on October 5, 1978.

During steady-state tests, the engine was operated at the following speed/load modes:

Speeds: 1,000; 1,500; 2,000; 2,500; 3,600; 4,300 rpm

Loads: 0, 10, 25, 40, 60, 75, 90, 100 pct of full load
(0, 10, 25, 60, and 75 pct points were repeated at
all engine speeds)

Idle speed/load modes: 800 rpm -- 0, 7, 15 lb-ft
650 rpm -- 8 lb-ft

Over-speed mode: 5,200 rpm -- 63 lb-ft (wide-open-throttle)

Total number of test modes..............................	69
Total number of repeats.................................	57
Total number of tests...............................	126

The following data were recorded for each test point:

Test number
Data source code
Date
Barometric pressure, mm Hg
Wet bulb temperature, °F
Dry bulb temperature, °F
Inlet air temperature, °F
Speed, rpm
Torque, lb-ft -- Daytronic strain gauge load cell
Fuel rate, lb/hr -- Fluidyne positive displacement fuel flow meter
Ignition timing, °BTC
Manifold vacuum, in. Hg
Intake manifold pressure, in. Hg
Throttle angle, degrees
CO, pct -- Beckman NDIR

CO_2, pct -- Beckman NDIR
O_2, pct -- Beckman polarographic detector
HC, ppmC -- Custom-built heated flame ionization detector
NO_X, ppm -- Thermo-Electron chemiluminescent detector
Oil temperature, °F
Oil pressure, psig
Coolant temperature, °F
Exhaust temperature, °F
Exhaust pressure, in. H_2O
Intake manifold temperature, °F

The following equations were used in calculating power, air-fuel ratio, absolute humidity, and mass emission rates of carbon monoxide (CO), unburned hydrocarbons (HC), and oxides of nitrogen (NO_X):

1. Partial pressure of water vapor in intake air (millimeters of mercury):

$$P = \exp\left[18.717 - \frac{7308.1}{393 + D}\right]$$

where D = Dew point, °F

2. Absolute humidity (grains moisture per pound dry air):

$$H = \frac{4347.8(P)}{B - P}$$

where B = Barometric pressure, mm Hg

3. Humidity correction factor (dimensionless):

$$K_H = \frac{1}{1 - 0.0047(H - 75)}$$

Note: This factor is used to correct the NO_X mass emission rate to a standard humidity of 75 grains moisture per pound dry air.

4. Hydrogen concentration in raw exhaust (percent):

$$H_2 = \frac{x(CO)(CO + CO_2)}{2(CO + 3CO_2)}$$

where CO = Carbon monoxide concentration (percent)
CO_2 = Carbon dioxide concentration (percent)
x = Fuel hydrogen/carbon atomic ratio

Note: This equation assumes a water-gas shift equilibrium constant:

$$\frac{(CO)(H_2O)}{(CO_2)(H_2)} = 3$$

5. Correction factor for emission concentrations from wet basis to dry basis (dimensionless):

$$C_w = 1 + \frac{(x/2)(CO + CO_2) - H_2}{100}$$

Note: In these tests only HC is measured on a wet basis. All other species are measured on a dry basis.

6. Air-fuel ratio (dimensionless):

$$AF = \frac{68.9994}{MW_{fuel}} \left[\frac{(1 + \frac{x}{2} - y)(CO) + (2 + \frac{x}{2} - y)(CO_2) + 2(O_2) + \frac{NO_x}{10^4} - H_2}{CO + CO_2 + C_w(HC/10^4)} \right]$$

where O_2 = Oxygen concentration (percent)
NO_x = Oxides of nitrogen (ppm)
HC = Unburned hydrocarbon concentration (ppmC)
y = Fuel oxygen/carbon atomic ratio
MW_{fuel} = Fuel molecular weight per carbon atom
= 12.01115 + 1.0079x + 15.9994y

7. Carbon monoxide mass emission rate (grams per hour):

$$M_{CO} = \left(\frac{MW_{CO}}{MW_{fuel}}\right) \left[\frac{CO \; (M_f)}{CO + CO_2 + C_w(\%HC)}\right] (453.59237)$$

MW_{CO} = Molecular weight of CO (28.01055)
M_f = Fuel rate in lb/hr
%HC = HC (ppmC)/10^4

8. Unburned hydrocarbon mass emission rate (grams per hour):

$$M_{HC} = \left(\frac{MW_{HC}}{MW_{fuel}}\right) \left[\frac{(\%HC)\;(M_f)\;(C_w)}{\%CO + \%CO_2 + C_w(\%HC)}\right] (453.59237)$$

MW_{HC} = Molecular weight of hydrocarbon per carbon atom
= 12.01115 + 1.00797x + 15.9994y

9. Oxides of nitrogen mass emission rate (grams per hour):

$$M_{NO_X} = \left(\frac{MW_{NO_X}}{MW_{fuel}}\right) \left[\frac{(\%NO_X) \quad (M_f)}{CO + CO_2 + C_w(\%HC)}\right] \quad (453.59237) \; K_H$$

MW_{NO_X} = Molecular weight of NO_2 = 46.0055
$\%NO_X$ = NO_X(ppm)10^4

10. Power (brake horsepower corrected to a standard barometric pressure of 736.6 mm Hg and a standard temperature of 85° F):

$$HP = \left(\frac{N\ (T)}{5252.113}\right) \left(\frac{736.6}{B - P}\right) \sqrt{\frac{t + 460}{545}}$$

where N = Engine speed (revolutions per minute)
T = Brake torque (lb-ft)
t = Air temperature (°F)

3. DISCUSSION OF TEST RESULTS

Maximum corrected brake horsepower, maximum torque, and brake specific fuel consumption (bsfc) are plotted as functions of engine speed at wide-open-throttle (WOT) in Figure 1. The maximum brake horsepower and the maximum torque produced by the engine were similar to the values quoted in Table 1 and were produced at the same speeds. Minimum bsfc occurred at 1,500 rpm indicating a high efficiency mode at this speed.

The fuel rates were found to be nearly a linear function of power for most engine speeds except for the 100 pct load mode for each speed where fuel-rich operation caused a significant increase in fuel rates (Figure 2). Fuel rates were repeatable for all speeds duplicated. The air-fuel ratios were maintained between 16 and 19 for all light and moderate speed/load modes (Figure 3). At the heavy load operating modes (greater than 60 percent of full load) air-fuel ratios were significantly reduced due to operation at the near WOT.

Emissions of CO, HC and NO_X are plotted as a function of power for all engine speeds (Figures 4 thru 6). Emissions of CO and HC were maintained at reasonably low levels for most speed/load modes. At WOT and at the two higher speeds (4,300 rpm and 5,000 rpm), significant increases in the emissions of CO and HC were observed. These increases correspond to fluctuations in the air-fuel ratio. Emission rates of NO_X tended to peak between 75 and 90 percent of full load for all engine speeds. These NO_X peaks correspond to engine operation near stoichiometric where emissions of NO_X are typically at their highest level. The emission rates of CO, HC, and NO_X were repeatable for all speeds tested.

4. CONCLUSIONS

The experimental work to obtain performance data for a 1978 Honda 98 CID engine has been completed; these data are presented in the tables accompanying this report.

TABLE 1. MANUFACTURER'S ENGINE SPECIFICATIONS

Displacement, cubic inches	98-CID
Maximum horsepower, bhp @ 5,000 rpm	68
Maximum torque, lb-ft @ 3,000 rpm	85
Bore and stroke, inches	2.91 x 3.66
Configuration	4-Cylinder in-line, transverse
Compression ratio	8.0 to 1
Firing order	1-3-4-2
Ignition timing at idle speed, BTDC @ 650 rpm	6°
Block material	cast iron
Head material	aluminum alloy
Number of crankshaft main bearing	5
Number of compression rings/piston	2
Number of oil rings/piston	1
Cam drive type	belt
Valve timing:	
Intake opens, °BTDC	42
Intake closes, °ABDC	87
Exhaust opens, °BBDC	92
Exhaust closes, °ATDC	42
Auxiliary valve:	
Opens, °BTDC	8
Closes, °ABDC	48
Spark plug gap, inches	.030
Weight of engine, lb	368
Crankcase emission control:	
Control method	positive crankcase ventilation
Point of discharge	air cleaner
Carburetor type	3-Barrel downdraft
Distributor specifications:	
Centrifugal advance, begins, ° @ 1,075 rpm	0
Centrifugal advance, intermediate, ° @ 1,800 rpm	11
Centrifugal advance, full, ° @ 2,800 rpm	18
Vacuum advance, begins, ° @ 4.72 in. Hg	0
Vacuum advance, maximum, ° @ 8.27 in. Hg	15
Carburetor number	CA24B013855
Distributor number	D409-66 803

TABLE 2. ENGINE BREAK IN SCHEDULE

Simulated vehicle speed, mph	Engine speed, rpm	Intake manifold vacuum, in. Hg	Fraction of time in mode
Idle	650	20.5	1/10
20	1,150	18	"
30	1,700	17.5	"
40	2,300	16	"
50	2,850	13.5	"
60	3,400	10	"
25	1,400	17	"
35	2,000	16.5	"
45	2,600	14.5	"
55	3,150	11.6	"

Mileage per cycle = 90 miles.
Total mileage accumulated over 40 hours break-in period = 1,440 miles.

TABLE 3. FUEL ANALYSIS

Fuel No	7718
Research octane No	91.8
Motor octane No	84.0
Specific gravity	0.717
API gravity, degrees	65.9
Distillation, °F:	
10 pct evaporated	123
50 pct "	209
95 pct "	402
100 pct "	413
Reid vapor pressure, psi	11.26
FIA analysis, pct:	
Aromatics	9
Olefins	15
Paraffins	76
Sulfur, pct	0.016
Lead, grams per gallon	Trace
Hydrogen/carbon atomic ratio	2.038

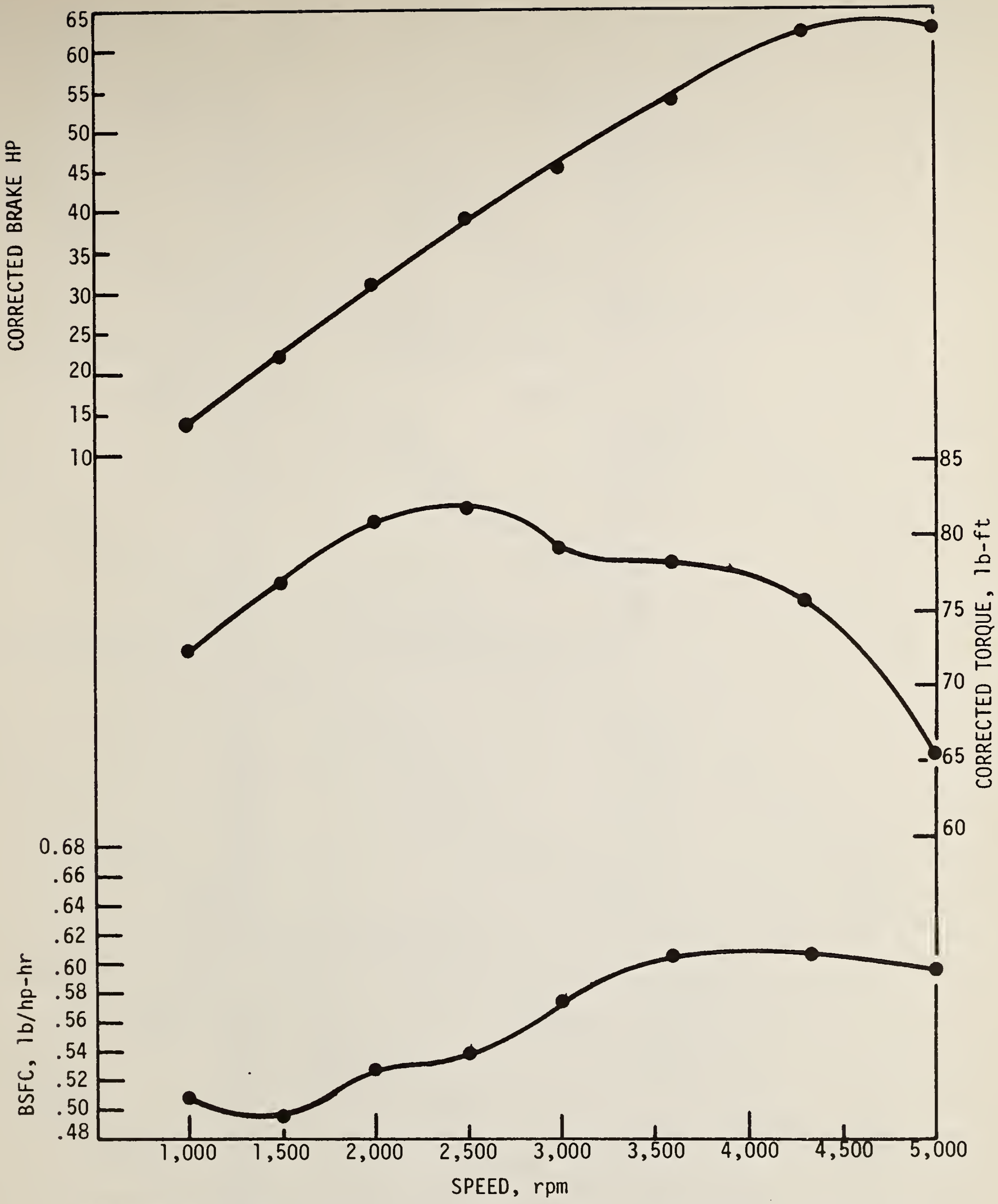


FIGURE 1. Brake Specific Fuel Consumption, Torque, and Brake Horsepower versus Engine rpm at Wide-Open-Throttle--Honda 98-CID Engine.

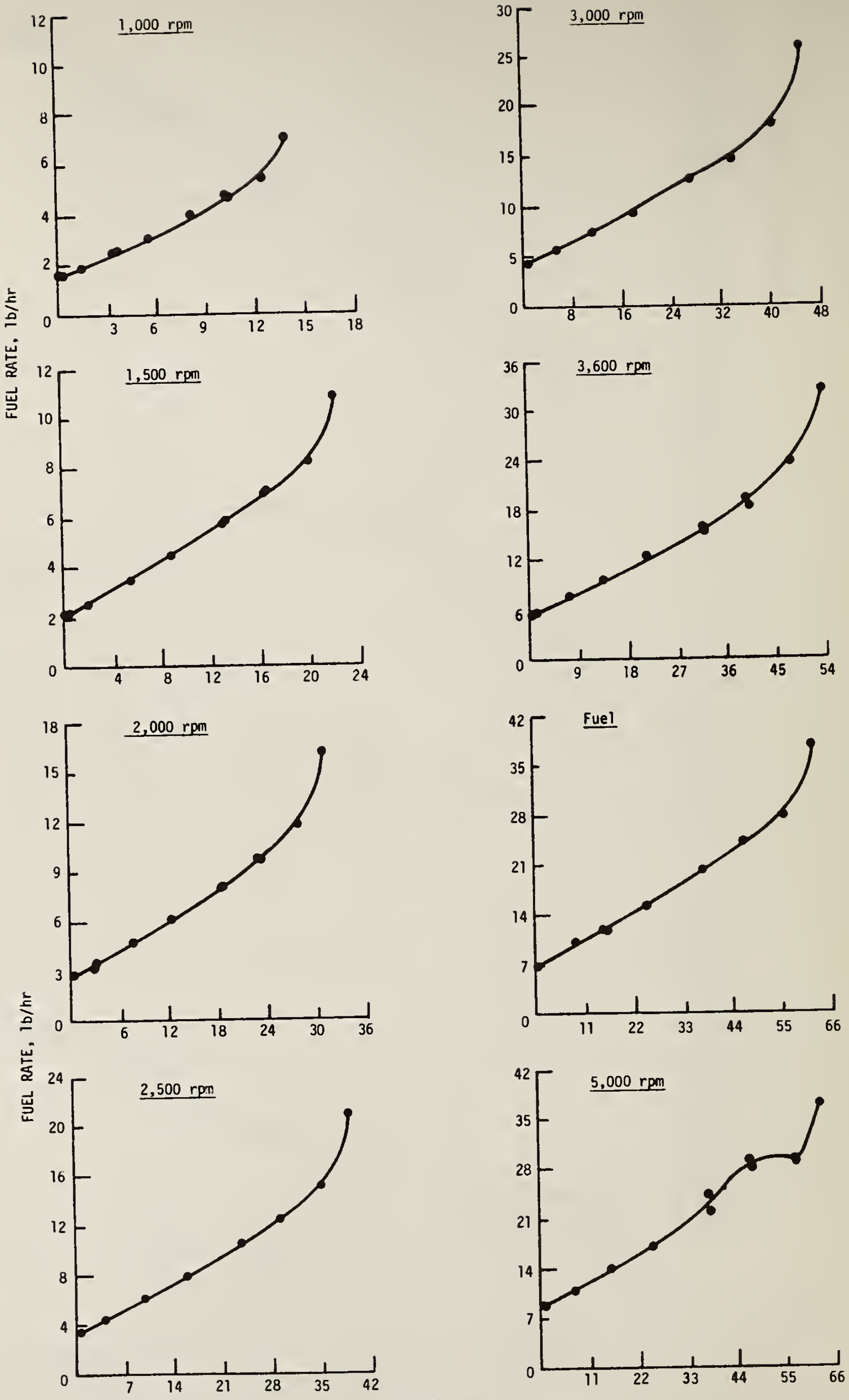


FIGURE 2. Fuel Rate versus Power at Various Speed and Load Conditions--Honda 98-CID Engine.

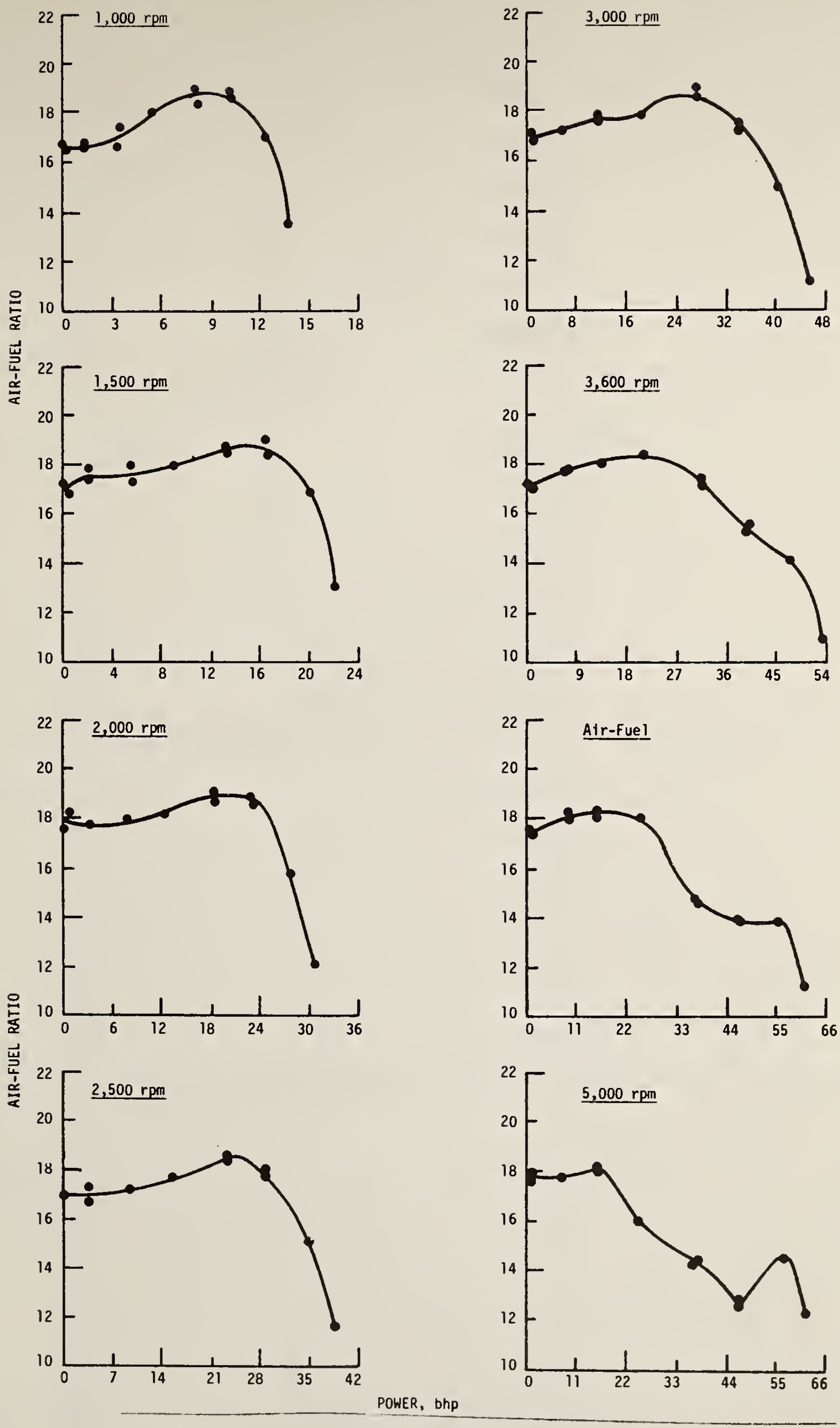


FIGURE 3. Air-Fuel Ratio versus Power at Various Speed and Load Conditions --Honda 98-CID Engine.

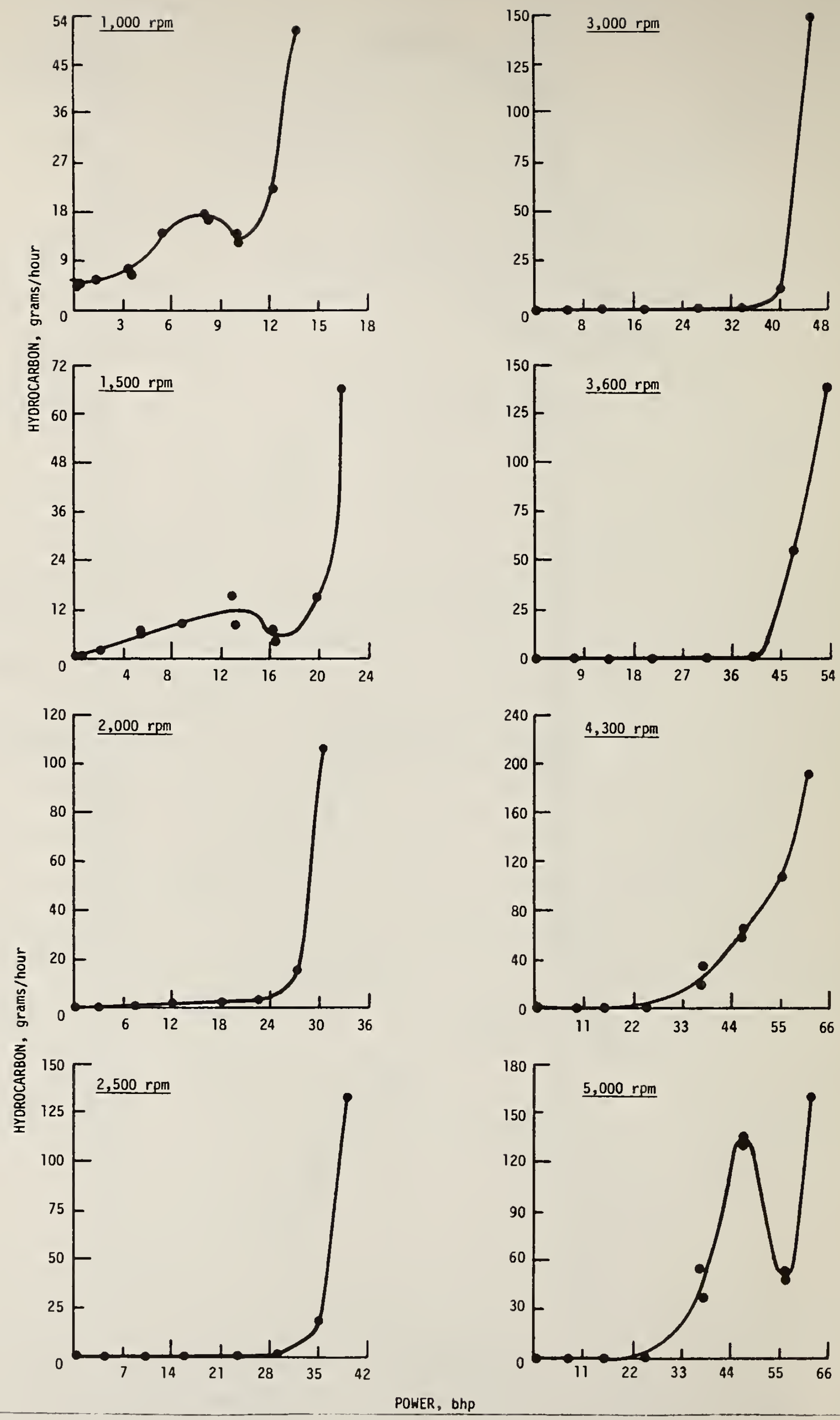


FIGURE 4. Hydrocarbon Emissions versus Power at Various Speed and Load Conditions--Honda 98-CID Engine.

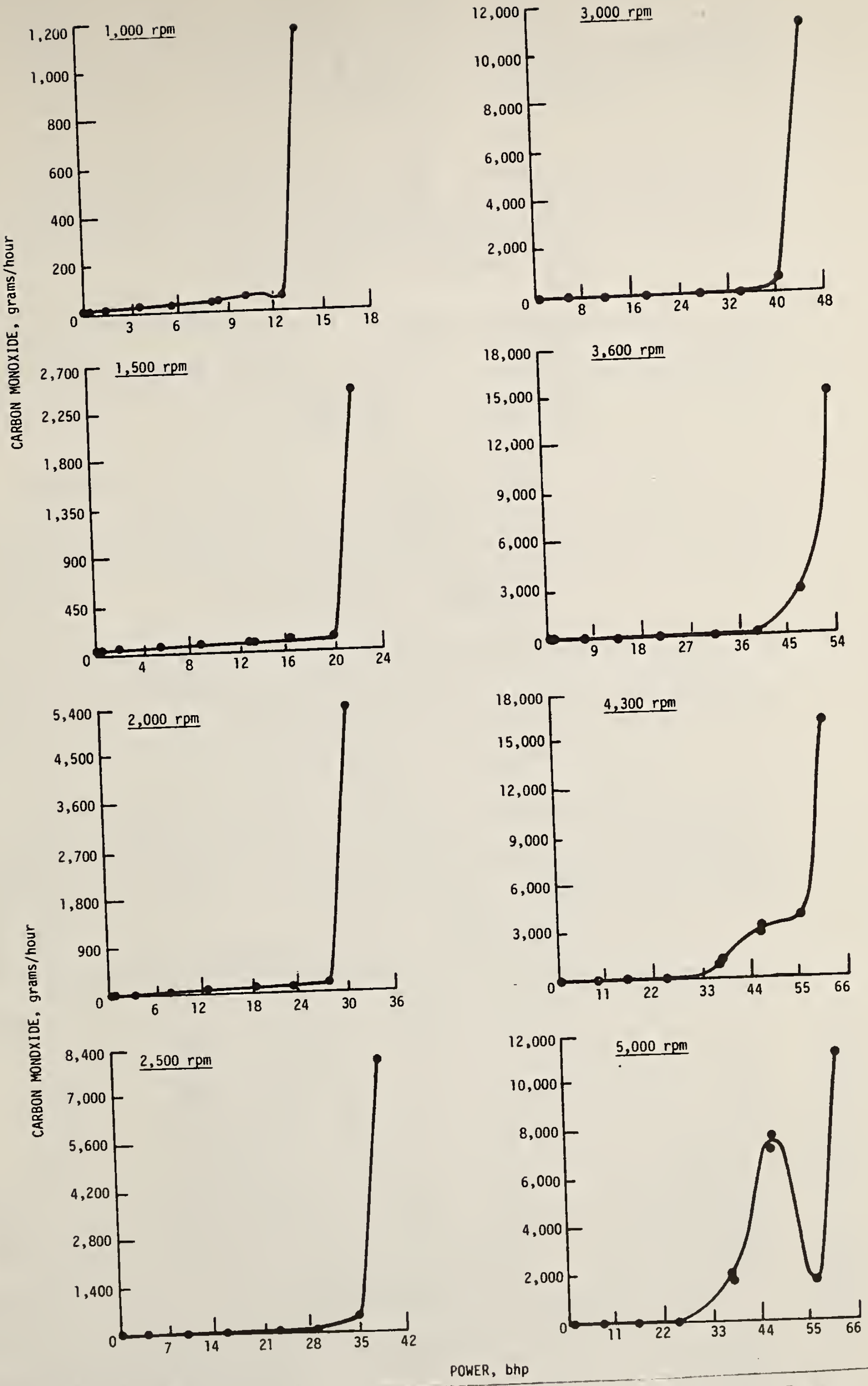


FIGURE 5. Carbon Monoxide Emissions versus Power at Various Speed and Load Conditions--Honda 98-CID Engine.

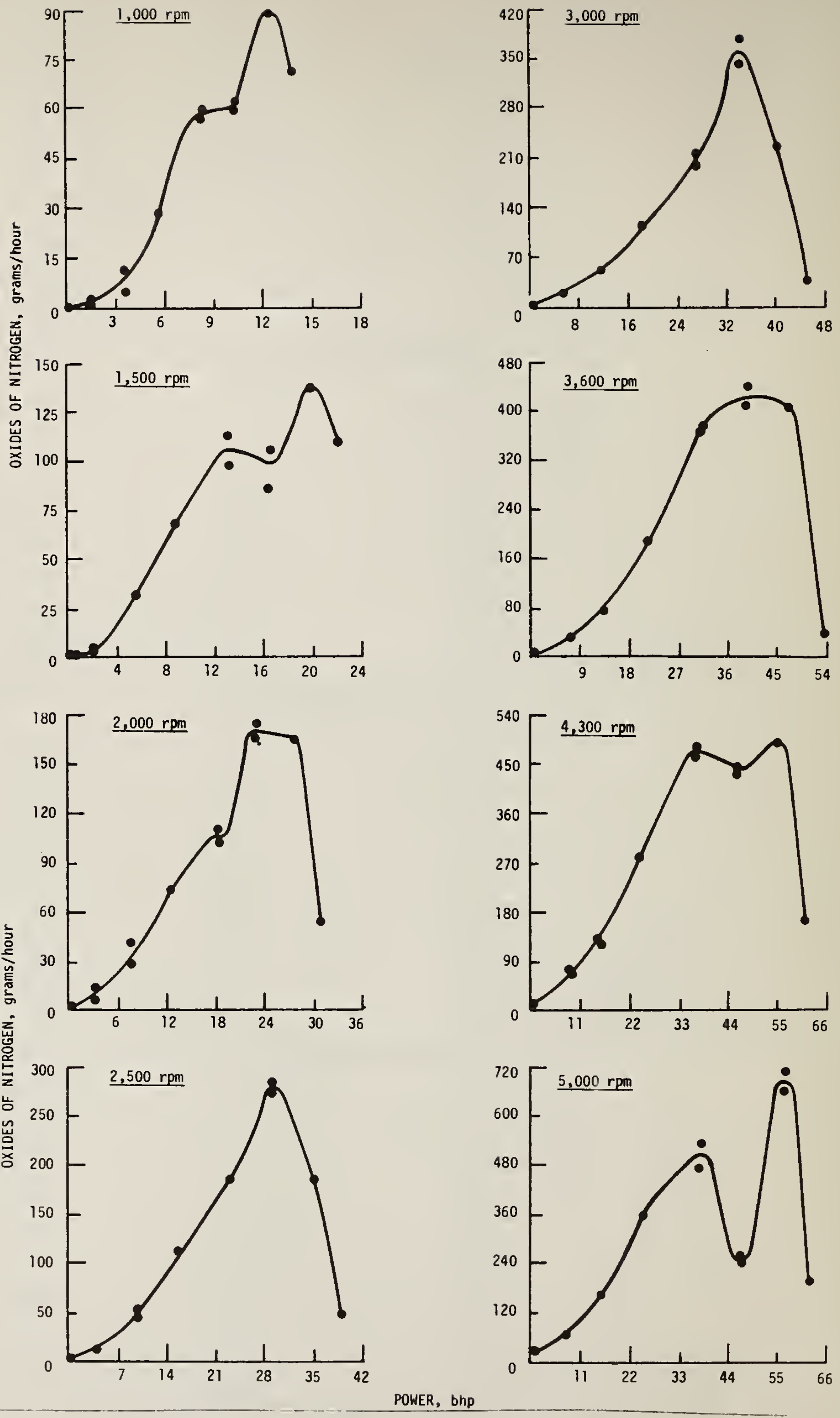


FIGURE 6. Oxides of Nitrogen Emissions versus Power at Various Speed and Load Conditions--Honda 98-CID Engine.

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	1.01	2.01	3.01	4.01	5.01	6.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/20/78	9/20/78	9/20/78	9/20/78	9/20/78	9/20/78
BAROMETER, MMHG	744.0	744.0	744.0	744.0	744.0	744.0
HUMIDITY, GRAINS/LB	75	75	75	75	75	75
TEMPERATURE, F	68	70	69	70	71	70
ENGINE SPEED, RPM	800	800	800	650	1000	1000
TORQUE, FT-LB	.0	7.0	15.0	7.9	72.7	65.4
POWER, BHP*	.0	1.1	2.3	1.0	13.8	12.4
FUEL RATE, LB/HR	1.1	1.3	1.8	1.1	7.0	5.4
IGNITION TIMING, DEG BTDC	6.0	6.0	6.0	6.0	6.0	9.0
MANIFOLD VACUUM, IN HG	21.0	19.5	17.0	19.5	.0	1.0
THROTTLE ANGLE, DEG	.0	1.0	2.0	.0	71.0	29.0
INTAKE MAN. TEMP., F	95	102	102	102	94	96
CONCENTRATIONS, DRY BASIS						
CO, %	.2049	.1391	.1262	.1564	2.9541	.1610
CO2, %	12.68	12.73	12.86	12.74	12.63	12.27
O2, %	2.59	2.70	2.44	2.57	.31	3.07
HC, PPMC	1328	2209	2302	3045	2565	1118
NOX, PPM	29	75	324	101	1091	1376
AIR/FUEL RATIO	16.51	16.52	16.31	16.31	13.53	17.05
EMISSION RATES, G/HR						
CO	16.0	12.4	15.5	12.0	1172.8	63.2
HC	5.2	9.9	14.2	11.8	51.1	22.0
NOX+	.4	1.1	6.6	1.3	71.4	89.0
OIL TEMPERATURE, F	185	179	178	177	202	196
OIL PRESSURE, PSI	29	36	38	30	34	36
COOLANT TEMPERATURE, F	187	187	188	187	185	189
EXHAUST PRESSURE, IN. H2O	1.0	1.0	1.0	1.0	7.0	6.0
EXHAUST TEMPERATURE, F	674	571	573	534	981	954

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	7.01	8.01	9.01	10.01	11.01	12.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/20/78	9/20/78	9/20/78	9/20/78	9/20/78	9/20/78
BAROMETER, MMHG	744.0	744.0	744.0	744.0	744.0	744.0
HUMIDITY, GRAINS/LB	75	75	75	75	75	75
TEMPERATURE, F	70	71	71	70	71	71
ENGINE SPEED, RPM	1000	1000	1000	1000	1000	1000
TORQUE, FT-LB	54.5	43.6	29.1	18.2	7.3	1.5
POWER, BHP*	10.3	8.3	5.5	3.5	1.4	.3
FUEL RATE, LB/HR	4.6	3.9	3.0	2.5	1.7	1.5
IGNITION TIMING, DEG BTDC	9.0	15.0	17.0	7.5	7.0	7.0
MANIFOLD VACUUM, IN HG	2.5	7.0	12.0	15.5	19.8	21.0
THROTTLE ANGLE, DEG	26.0	10.0	6.4	4.5	2.0	1.0
INTAKE MAN. TEMP., F	99	99	99	100	98	97
CONCENTRATIONS, DRY BASIS						
CO, %	.1799	.1479	.1478	.1818	.1773	.1764
CO2, %	11.08	11.37	11.57	12.06	12.64	12.66
O2, %	4.65	4.47	4.19	3.53	2.68	2.56
HC, PPMC	664	1103	1226	725	866	898
NOX, PPM	1025	1188	767	168	56	28
AIR/FUEL RATIO	18.69	18.41	18.08	17.45	16.66	16.56
EMISSION RATES, G/HR						
CO	66.0	45.1	33.5	32.9	21.6	18.0
HC	12.2	16.9	14.0	6.6	5.3	4.6
NOX+	62.0	59.8	28.7	5.0	1.1	.5
OIL TEMPERATURE, F	195	193	191	189	187	184
OIL PRESSURE, PSI	36	40	40	40	40	45
COOLANT TEMPERATURE, F	188	189	188	188	188	187
EXHAUST PRESSURE, IN. H2O	5.0	4.0	3.0	2.0	1.0	.0
EXHAUST TEMPERATURE, F	934	879	820	780	714	672

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	13.01	14.01	15.01	16.01	17.01	19.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/20/78	9/20/78	9/20/78	9/20/78	9/20/78	9/20/78
BAROMETER, MMHG	744.0	744.0	744.0	744.0	744.0	744.0
HUMIDITY, GRAINS/LB	75	75	75	75	75	75
TEMPERATURE, F	72	73	75	73	72	72
ENGINE SPEED, RPM	1500	1500	1500	1500	1500	1500
TORQUE, FT-LB	77.5	69.8	58.1	46.5	31.0	7.0
POWER, BHP*	22.0	19.9	16.5	13.2	8.8	2.0
FUEL RATE, LB/HR	10.9	8.2	7.1	5.9	4.5	2.5
IGNITION TIMING, DEG BTDC	15.0	15.0	15.0	24.0	28.0	15.0
MANIFOLD VACUUM, IN HG	.5	1.4	3.5	7.4	12.5	20.0
THROTTLE ANGLE, DEG	71.0	28.0	23.0	15.0	10.0	4.5
INTAKE MAN. TEMP., F	78	90	93	95	96	97
CONCENTRATIONS, DRY BASIS						
CO, %	4.0634	.1898	.1928	.2092	.2162	.2297
CO2, %	12.02	12.44	11.40	11.32	11.67	12.14
O2, %	.22	2.84	4.37	4.46	4.01	3.43
HC, PPMC	2161	506	149	363	500	210
NOX, PPM	1099	1412	1155	1286	1207	69
AIR/FUEL RATIO	13.06	16.91	18.43	18.49	17.97	17.39
EMISSION RATES, G/HR						
CO	2453.2	111.5	106.7	96.1	73.3	42.2
HC	65.5	14.9	4.1	8.4	8.5	1.9
NOX+	109.4	136.7	105.4	97.4	67.5	2.1
OIL TEMPERATURE, F	199	207	208	206	203	196
OIL PRESSURE, PSI	50	50	50	50	50	50
COOLANT TEMPERATURE, F	189	189	189	189	189	188
EXHAUST PRESSURE, IN. H2O	9.0	8.0	7.0	5.0	5.0	4.0
EXHAUST TEMPERATURE, F	1109	1134	1117	1059	975	880

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	20.01	21.01	22.01	24.01	25.01	26.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/20/78	9/20/78	9/20/78	9/20/78	9/20/78	9/20/78
BAROMETER, MMHG	744.0	745.0	745.0	745.0	745.0	745.0
HUMIDITY, GRAINS/LB	75	67	67	67	67	67
TEMPERATURE, F	72	75	76	77	76	76
ENGINE SPEED, RPM	1500	2000	2000	2000	2000	2000
TORQUE, FT-LB	1.6	81.9	73.7	49.0	32.8	20.5
POWER, BHP*	.5	30.9	27.8	18.5	12.4	7.7
FUEL RATE, LB/HR	2.2	16.3	11.9	8.2	6.2	4.8
IGNITION TIMING, DEG BTDC	15.0	19.0	19.0	24.0	32.0	32.0
MANIFOLD VACUUM, IN HG	21.0	1.0	2.0	6.5	11.8	15.6
THROTTLE ANGLE, DEG	3.0	71.0	40.0	21.0	14.0	10.0
INTAKE MAN. TEMP., F	97	65	69	93	96	97
CONCENTRATIONS, DRY BASIS						
CO, %	.1836	6.3043	.2290	.1698	.1980	.1920
CO2, %	12.59	10.68	13.40	11.36	11.66	11.79
O2, %	2.80	.16	1.60	4.69	4.23	4.04
HC, PPMC	94	2477	400	65	110	65
NOX, PPM	51	394	1315	1010	977	492
AIR/FUEL RATIO	16.86	12.10	15.85	18.74	18.23	18.03
EMISSION RATES, G/HR						
CO	29.1	5384.6	180.3	108.6	93.6	69.6
HC	.7	106.2	15.8	2.1	2.6	1.2
NOX+	1.3	53.4	164.5	102.6	73.4	28.3
OIL TEMPERATURE, F	193	221	222	216	211	207
OIL PRESSURE, PSI	50	50	50	50	50	50
COOLANT TEMPERATURE, F	187	190	189	189	188	189
EXHAUST PRESSURE, IN. H2O	3.0	15.0	14.0	11.0	10.0	8.0
EXHAUST TEMPERATURE, F	850	1217	1299	1195	1105	1064

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	27.01	28.01	29.01	30.01	33.01	34.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/20/78	9/20/78	9/20/78	9/20/78	9/20/78	9/20/78
BAROMETER, MMHG	745.0	745.0	745.0	745.0	745.0	745.0
HUMIDITY, GRAINS/LB	67	67	67	67	67	67
TEMPERATURE, F	75	75	77	79	80	80
ENGINE SPEED, RPM	2000	2000	2500	2500	2500	2500
TORQUE, FT-LB	8.2	1.7	82.5	74.3	33.0	20.6
POWER, BHP*	3.1	.6	39.0	35.1	15.6	9.7
FUEL RATE, LB/HR	3.3	2.9	21.0	15.2	7.9	6.0
IGNITION TIMING, DEG BTDC	31.0	21.0	21.0	21.0	35.0	35.0
MANIFOLD VACUUM, IN HG	19.5	21.0	1.0	2.4	11.5	15.5
THROTTLE ANGLE, DEG	6.5	5.5	71.0	41.5	17.0	12.5
INTAKE MAN. TEMP., F	100	99	67	71	97	99
CONCENTRATIONS, DRY BASIS						
CO, %	.2019	.1208	7.4971	.4755	.1176	.0719
CO2, %	11.93	11.76	9.97	13.84	12.08	12.48
O2, %	3.78	4.22	.14	.74	3.66	3.17
HC, PPMC	63	82	2448	373	17	8
NOX, PPM	178	82	277	1207	1199	660
AIR/FUEL RATIO	17.76	18.22	11.63	15.10	17.73	17.28
EMISSION RATES, G/HR						
CO	49.6	26.2	8020.7	455.8	68.9	30.9
HC	.8	.9	131.5	18.0	.5	.2
NOX+	7.0	2 8	47.1	183.9	111.6	45.0
OIL TEMPERATURE, F	207	200	219	228	223	219
OIL PRESSURE, PSI	50	50	55	55	55	55
COOLANT TEMPERATURE, F	188	188	188	190	189	189
EXHAUST PRESSURE, IN. H2O	5.0	4.0	26.0	25.0	12.0	6.0
EXHAUST TEMPERATURE, F	994	989	1378	1408	1220	1172

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	35.01	36.01	37.01	38.01	41.01	42.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/20/78	9/20/78	9/20/78	9/20/78	9/20/78	9/20/78
BAROMETER, MMHG	745.0	745.0	745.0	745.0	745.0	745.0
HUMIDITY, GRAINS/LB	67	67	67	67	67	67
TEMPERATURE, F	79	79	79	79	78	79
ENGINE SPEED, RPM	2500	2500	3000	3000	3000	3000
TORQUE, FT-LB	8.3	1.5	80.0	72.0	32.0	20.0
POWER, BHP*	3.9	.7	45.3	40.8	18.1	11.3
FUEL RATE, LB/HR	4.3	3.5	26.0	18.2	9.3	7.4
IGNITION TIMING, DEG BTDC	34.0	34.0	25.0	25.0	38.0	37.0
MANIFOLD VACUUM, IN HG	19.2	21.0	1.0	2.5	11.5	15.2
THROTTLE ANGLE, DEG	9.0	6.0	71.0	44.0	19.5	15.0
INTAKE MAN. TEMP., F	100	102	60	70	95	95
CONCENTRATIONS, DRY BASIS						
CO, %	.0511	.0229	8.6673	.5621	.0702	.0480
CO2, %	12.44	12.64	9.17	14.11	11.96	12.10
O2, %	3.26	2.89	.10	.54	3.73	3.56
HC, PPMC	4	2	2258	183	17	8
NOX, PPM	245	117	181	1261	1017	577
AIR/FUEL RATIO	17.36	17.04	11.15	14.94	17.86	17.68
EMISSION RATES, G/HR						
CO	16.1	5.7	11268.6	629.6	49.2	26.3
HC	.1	.0	147.4	10.3	.6	.2
NOX+	12.2	4.6	37.5	224.5	113.2	50.2
OIL TEMPERATURE, F	215	211	228	238	206	219
OIL PRESSURE, PSI	55	55	55	55	55	55
COOLANT TEMPERATURE, F	189	188	190	190	189	188
EXHAUST PRESSURE, IN. H2O	4.0	4.0	40.0	35.0	13.0	10.0
EXHAUST TEMPERATURE, F	1131	1094	1306	1505	1251	1243

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	43.01	44.01	45.01	46.01	47.01	48.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/20/78	9/20/78	9/20/78	9/22/78	9/22/78	9/22/78
BAROMETER, MMHG	745.0	745.0	745.0	755.0	755.0	755.0
HUMIDITY, GRAINS/LB	67	67	67	54	54	54
TEMPERATURE, F	80	80	80	68	69	69
ENGINE SPEED, RPM	3000	3000	3600	3600	3600	3600
TORQUE, FT-LB	9.6	1.4	78.9	71.0	59.2	47.0
POWER, BHP*	5.4	.8	53.7	47.6	39.7	31.5
FUEL RATE, LB/HR	5.6	4.3	32.5	23.7	19.2	15.9
IGNITION TIMING, DEG BTDC	37.0	37.0	26.0	26.0	27.0	32.0
MANIFOLD VACUUM, IN HG	18.5	20.8	1.2	3.2	5.5	6.4
THROTTLE ANGLE, DEG	11.5	9.0	71.0	46.5	35.0	32.0
INTAKE MAN. TEMP., F	97	99	71	61	68	65
CONCENTRATIONS, DRY BASIS						
CO, %	.0261	.0110	9.5959	1.9786	.1907	.0385
CO2, %	12.45	12.87	8.77	13.43	14.12	12.49
O2, %	3.09	2.74	.08	.17	.75	3.17
HC, PPMC	4	3	1726	780	30	15
NOX, PPM	271	122	138	1959	2240	2139
AIR/FUEL RATIO	17.24	16.89	10.86	14.05	15.31	17.36
EMISSION RATES, G/HR						
CO	10.6	3.3	15213.3	2732.5	231.2	44.1
HC	.1	.0	137.5	54.1	1.8	.8
NOX+	17.6	5.8	34.8	404.8	406.5	366.7
OIL TEMPERATURE, F	220	218	240	220	245	247
OIL PRESSURE, PSI	55	55	55	55	55	55
COOLANT TEMPERATURE, F	189	188	190	190	190	191
EXHAUST PRESSURE, IN. H2O	8.0	6.0	65.0	54.0	45.0	36.0
EXHAUST TEMPERATURE, F	1215	1185	1362	1563	1580	1441

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	49.01	50.01	51.01	52.01	53.01	54.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/22/78	9/22/78	9/22/78	9/22/78	9/22/78	9/22/78
BAROMETER, MMHG	755.0	755.0	755.0	755.0	755.0	755.0
HUMIDITY, GRAINS/LB	54	54	54	54	54	54
TEMPERATURE, F	67	67	67	67	69	70
ENGINE SPEED, RPM	3600	3600	3600	3600	4300	4300
TORQUE, FT-LB	31.6	19.7	10.6	.5	77.6	69.8
POWER, BHP*	21.2	13.2	7.1	.3	62.1	55.9
FUEL RATE, LB/HR	12.3	9.4	7.3	5.4	33.0	28.0
IGNITION TIMING, DEG BTDC	39.0	38.0	38.0	38.0	28.0	27.0
MANIFOLD VACUUM, IN HG	10.5	14.6	17.4	20.8	1.5	3.0
THROTTLE ANGLE, DEG	24.5	18.5	15.0	10.0	71.0	51.0
INTAKE MAN. TEMP., F	75	81	82	82	63	71
CONCENTRATIONS, DRY BASIS						
CO, %	.0460	.0314	.0256	.0096	5.0174	2.4073
CO2, %	11.75	11.99	12.09	12.60	11.71	13.25
O2, %	4.29	3.89	3.75	2.99	.03	.16
HC, PPMC	9	6	4	3	1585	1326
NOX, PPM	1349	706	400	174	973	2029
AIR/FUEL RATIO	18.41	18.00	17.85	17.14	12.64	13.82
EMISSION RATES, G/HR						
CO	43.2	22.2	14.0	3.7	8868.4	3855.4
HC	.4	.2	.1	.1	140.7	106.6
NOX+	189.7	74.7	32.7	10.0	257.3	486.3
OIL TEMPERATURE, F	243	238	234	229	259	270
OIL PRESSURE, PSI	55	55	55	55	55	55
COOLANT TEMPERATURE, F	190	190	189	189	192	192
EXHAUST PRESSURE, IN. H2O	35.0	16.0	11.0	6.0	90.0	75.0
EXHAUST TEMPERATURE, F	1379	1336	1291	1252	1524	1571

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	55.01	56.01	57.01	58.01	59.01	60.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/22/78	9/22/78	9/22/78	9/22/78	9/22/78	9/22/78
BAROMETER, MMHG	755.0	755.0	755.0	755.0	755.0	755.0
HUMIDITY, GRAINS/LB	54	54	54	54	54	54
TEMPERATURE, F	69	67	69	69	68	69
ENGINE SPEED, RPM	4300	4300	4300	4300	4300	4300
TORQUE, FT-LB	58.2	46.6	31.0	19.4	11.4	.6
POWER, BHP*	46.6	37.3	24.8	15.5	9.1	.5
FUEL RATE, LB/HR	24.1	20.3	15.1	11.8	10.2	6.9
IGNITION TIMING, DEG BTDC	28.0	39.0	39.0	39.0	39.0	39.0
MANIFOLD VACUUM, IN HG	5.5	8.2	10.0	13.5	15.0	20.0
THROTTLE ANGLE, DEG	36.0	31.0	29.0	22.0	19.5	13.5
INTAKE MAN. TEMP., F	70	63	69	80	82	84
CONCENTRATIONS, DRY BASIS						
CO, %	2.0793	.6983	.0373	.0326	.0252	.0095
CO2, %	13.46	14.00	11.87	11.69	11.74	12.27
O2, %	.16	.35	3.90	4.18	4.12	3.40
HC, PPMC	820	305	11	6	4	2
NOX, PPM	2054	2479	1631	954	623	218
AIR/FUEL RATIO	14.01	14.78	18.07	18.33	18.26	17.53
EMISSION RATES, G/HR						
CO	2897.0	870.2	42.7	29.7	19.8	4.8
HC	57.4	19.1	.6	.3	.2	.1
NOX+	428.2	462.2	279.7	130.1	73.3	16.5
OIL TEMPERATURE, F	274	230	250	251	250	246
OIL PRESSURE, PSI	55	55	55	55	55	55
COOLANT TEMPERATURE, F	190	190	190	190	189	188
EXHAUST PRESSURE, IN. H2O	60.0	44.0	38.0	24.0	19.0	10.0
EXHAUST TEMPERATURE, F	1583	1541	1432	1380	1360	1318

* CORRECTED SAE J8168
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	61.01	63.01	64.01	65.01	66.01	67.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/22/78	9/22/78	9/22/78	9/22/78	9/22/78	9/25/78
BAROMETER, MMHG	755.0	755.0	755.0	755.0	755.0	749.5
HUMIDITY, GRAINS/LB	54	54	54	54	54	76
TEMPERATURE, F	70	72	71	72	71	79
ENGINE SPEED, RPM	5000	5000	5000	5000	5000	5000
TORQUE, FT-LB	67.0	50.3	40.2	26.8	16.7	8.3
POWER, BHP*	62.4	46.8	37.4	24.9	15.5	7.8
FUEL RATE, LB/HR	37.1	29.2	24.3	17.0	13.8	10.7
IGNITION TIMING, DEG BTDC	25.0	27.0	35.0	38.0	38.0	39.0
MANIFOLD VACUUM, IN HG	1.6	6.0	9.0	12.0	13.5	17.0
THROTTLE ANGLE, DEG	71.0	35.0	32.0	28.0	25.0	21.0
INTAKE MAN. TEMP., F	67	72	73	67	81	90
CONCENTRATIONS, DRY BASIS						
CO, %	5.8203	4.5687	1.3876	.0239	.0231	.0152
CO2, %	11.28	11.88	13.81	13.56	11.82	12.30
O2, %	.01	.04	.14	1.58	4.11	3.77
HC, PPMC	1643	1702	753	12	6	4
NOX, PPM	657	1062	2180	2104	1011	480
AIR/FUEL RATIO	12.32	12.80	14.29	16.02	18.25	17.83
EMISSION RATES, G/HR						
CO	11282.8	7261.0	1994.8	26.9	24.4	11.9
HC	160.0	135.8	54.4	.7	.3	.2
NOX+	190.6	252.6	469.1	354.9	159.7	62.2
OIL TEMPERATURE, F	283	289	291	285	272	243
OIL PRESSURE, PSI	55	55	55	55	55	55
COOLANT TEMPERATURE, F	192	192	190	190	189	190
EXHAUST PRESSURE, IN. H2O	112.0	75.0	60.0	39.0	30.0	16.0
EXHAUST TEMPERATURE, F	1561	1541	1549	1528	1438	1397

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	68.01	69.01	70.01	71.01	72.01	73.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/22/78	9/22/78	9/22/78	5/28/78	9/22/78	9/22/78
BAROMETER, MMHG	755.0	753.1	753.1	753.1	753.1	753.1
HUMIDITY, GRAINS/LB	54	54	54	54	54	54
TEMPERATURE, F	72	75	74	73	75	76
ENGINE SPEED, RPM	5000	800	800	800	650	1000
TORQUE, FT-LB	1.0	.0	7.0	15.0	5.6	54.5
POWER, BHP*	.9	.0	1.0	2.2	.7	10.2
FUEL RATE, LB/HR	8.6	1.1	1.4	1.8	1.3	4.7
IGNITION TIMING, DEG BTDC	38.0	6.0	6.0	6.0	6.0	9.0
MANIFOLD VACUUM, IN HG	18.8	21.5	19.8	17.0	20.5	3.5
THROTTLE ANGLE, DEG	17.0	.0	1.0	2.0	.0	18.0
INTAKE MAN. TEMP., F	86	85	88	87	87	86
CONCENTRATIONS, DRY BASIS						
CO, %	.0088	.2405	.1560	.1238	.1734	.1784
CO2, %	12.25	12.50	12.57	12.39	12.89	11.17
O2, %	3.54	2.94	2.93	3.21	2.37	4.98
HC, PPMC	2	1503	2853	2633	3163	759
NOX, PPM	276	44	136	340	115	1075
AIR/FUEL RATIO	17.65	16.76	16.63	16.92	16.12	18.93
EMISSION RATES, G/HR						
CO	5.6	18.0	15.2	15.7	15.1	65.7
HC	.1	5.6	14.0	16.8	13.9	14.0
NOX+	26.3	.5	2.0	6.5	1.5	59.3
OIL TEMPERATURE, F	268	186	178	177	176	187
OIL PRESSURE, PSI	55	35	35	35	35	40
COOLANT TEMPERATURE, F	188	187	187	188	187	188
EXHAUST PRESSURE, IN. H2O	15.0	1.0	1.0	2.0	2.0	5.0
EXHAUST TEMPERATURE, F	1388	703	588	587	538	917

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	74.01	75.01	76.01	77.01	78.01	79.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/22/78	9/22/78	9/22/78	9/22/78	9/22/78	9/22/78
BAROMETER, MMHG	753.1	753.1	753.1	753.1	753.1	753.1
HUMIDITY, GRAINS/LB	54	54	54	54	54	54
TEMPERATURE, F	75	76	75	75	72	74
ENGINE SPEED, RPM	1000	1000	1000	1000	1500	1500
TORQUE, FT-LB	43.6	18.2	7.3	.0	58.1	46.5
POWER, BHP*	8.1	3.4	1.4	.0	16.3	13.0
FUEL RATE, LB/HR	3.9	2.4	1.8	1.5	7.0	5.8
IGNITION TIMING, DEG BTDC	12.0	7.0	7.0	7.0	14.0	23.0
MANIFOLD VACUUM, IN HG	7.0	16.5	19.8	21.5	4.0	7.5
THROTTLE ANGLE, DEG	11.0	4.0	2.0	1.0	22.0	15.0
INTAKE MAN. TEMP., F	86	87	87	87	80	84
CONCENTRATIONS, DRY BASIS						
CO, %	.1425	.1912	.2030	.1977	.1955	.1860
CO2, %	11.00	12.72	12.51	12.67	11.05	11.17
O2, %	5.07	2.74	2.89	2.82	4.98	4.73
HC, PPMC	1108	866	846	834	255	660
NOX, PPM	1200	455	144	75	1020	1629
AIR/FUEL RATIO	19.06	16.71	16.83	16.76	19.04	18.75
EMISSION RATES, G/HR						
CO	45.0	32.0	25.7	20.1	110.0	85.9
HC	17.6	7.3	5.4	4.3	7.2	15.3
NOX+	56.7	11.4	2.7	1.1	86.0	112.6
OIL TEMPERATURE, F	188	187	184	181	166	186
OIL PRESSURE, PSI	40	40	40	40	45	45
COOLANT TEMPERATURE, F	188	187	187	187	178	189
EXHAUST PRESSURE, IN. H2O	5.0	4.0	2.0	1.0	6.0	5.0
EXHAUST TEMPERATURE, F	866	781	728	669	1082	1030

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	80.01	81.01	82.01	83.01	84.01	85.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/22/78	9/22/78	9/22/78	9/22/78	9/22/78	9/22/78
BAROMETER, MMHG	753.1	753.1	753.1	753.1	753.1	753.1
HUMIDITY, GRAINS/LB	54	54	54	54	54	54
TEMPERATURE, F	75	75	75	72	75	76
ENGINE SPEED, RPM	1500	1500	1500	2000	2000	2000
TORQUE, FT-LB	19.4	7.1	.2	61.4	49.0	20.5
POWER, BHP*	5.4	2.0	.1	22.9	18.3	7.7
FUEL RATE, LB/HR	3.5	2.6	2.1	9.9	8.1	4.8
IGNITION TIMING, DEG BTDC	26.0	13.0	13.0	17.0	24.0	30.0
MANIFOLD VACUUM, IN HG	16.5	19.5	21.6	2.1	6.2	16.0
THROTTLE ANGLE, DEG	7.5	5.0	3.0	37.0	21.5	10.0
INTAKE MAN. TEMP., F	85	85	87	85	85	85
CONCENTRATIONS, DRY BASIS						
CO, %	.2303	.2307	.1908	.1569	.1722	.1760
CO2, %	11.67	11.86	12.31	11.20	11.09	11.84
O2, %	4.06	3.92	3.16	4.83	5.04	3.93
HC, PPMC	500	228	112	90	91	54
NOX, PPM	783	168	99	1411	1138	763
AIR/FUEL RATIO	17.99	17.84	17.18	18.94	19.14	17.95
EMISSION RATES, G/HR						
CO	61.6	45.4	29.4	123.1	111.4	63.8
HC	6.7	2.3	.9	3.5	3.0	1.0
NOX+	31.3	5.0	2.3	165.8	110.3	41.4
OIL TEMPERATURE, F	191	189	188	195	201	201
OIL PRESSURE, PSI	50	50	50	55	55	55
COOLANT TEMPERATURE, F	188	188	187	189	189	188
EXHAUST PRESSURE, IN. H2O	4.0	3.0	2.0	15.0	11.0	7.0
EXHAUST TEMPERATURE, F	938	879	843	1198	1162	1067

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	86.01	87.01	88.01	89.01	90.01	91.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/22/78	9/22/78	9/25/78	9/25/78	9/25/78	9/25/78
BAROMETER, MMHG	753.1	753.1	749.6	749.6	749.6	749.6
HUMIDITY, GRAINS/LB	54	54	76	76	76	76
TEMPERATURE, F	75	76	73	74	77	78
ENGINE SPEED, RPM	2000	2000	2500	2500	2500	2500
TORQUE, FT-LB	8.2	.3	61.9	49.5	20.6	8.3
POWER, BHP*	3.1	.1	29.1	23.3	9.7	3.9
FUEL RATE, LB/HR	3.6	2.9	12.7	10.5	6.2	4.4
IGNITION TIMING, DEG BTDC	30.0	17.0	21.0	27.0	35.0	35.0
MANIFOLD VACUUM, IN HG	19.5	22.0	3.0	6.2	15.5	19.5
THROTTLE ANGLE, DEG	7.0	5.0	38.0	26.0	13.5	10.0
INTAKE MAN. TEMP., F	86	87	76	81	85	86
CONCENTRATIONS, DRY BASIS						
CO, %	.1694	.0733	.0682	.0932	.0688	.0418
CO2, %	12.10	12.12	12.06	11.74	12.54	12.93
O2, %	3.68	3.50	3.70	4.31	3.20	2.56
HC, PPMC	44	14	44	32	19	13
NOX, PPM	347	108	1754	1384	714	247
AIR/FUEL RATIO	17.68	17.59	17.83	18.39	17.29	16.74
EMISSION RATES, G/HR						
CO	45.5	15.5	64.3	74.9	30.6	12.9
HC	.6	.1	2.1	1.3	.4	.2
NOX+	13.9	3.4	273.9	184.3	52.6	12.6
OIL TEMPERATURE, F	198	196	218	218	215	210
OIL PRESSURE, PSI	55	55	55	55	55	55
COOLANT TEMPERATURE, F	188	188	189	189	188	187
EXHAUST PRESSURE, IN. H2O	5.0	4.0	24.0	18.0	6.0	4.0
EXHAUST TEMPERATURE, F	992	967	1336	1288	1184	1125

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	92.01	93.01	94.01	95.01	96.01	97.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/25/78	9/25/78	9/25/78	9/25/78	9/25/78	9/25/78
BAROMETER, MMHG	749.6	749.6	749.6	749.6	749.6	749.6
HUMIDITY, GRAINS/LB	76	76	76	76	76	76
TEMPERATURE, F	77	74	77	76	76	77
ENGINE SPEED, RPM	2500	3000	3000	3000	3000	3000
TORQUE, FT-LB	.9	60.0	48.0	20.0	9.6	1.0
POWER, BHP*	.4	33.9	27.1	11.3	5.4	.6
FUEL RATE, LB/HR	3.5	14.8	12.8	7.6	5.8	4.4
IGNITION TIMING, DEG BTDC	33.0	25.0	29.0	38.0	38.0	38.0
MANIFOLD VACUUM, IN HG	21.5	4.5	6.0	15.2	18.5	21.5
THROTTLE ANGLE, DEG	7.0	35.0	31.0	16.0	12.0	10.0
INTAKE MAN. TEMP., F	88	68	78	84	85	88
CONCENTRATIONS, DRY BASIS						
CO, %	.0246	.0481	.0651	.0474	.0266	.0122
CO2, %	12.75	12.63	11.64	12.18	12.63	12.83
O2, %	2.89	3.07	4.53	3.80	3.16	2.99
HC, PPMC	10	19	14	9	7	5
NOX, PPM	121	1965	1316	618	314	148
AIR/FUEL RATIO	17.03	17.23	18.62	17.86	17.26	17.09
EMISSION RATES, G/HR						
CO	6.0	50.7	64.1	26.4	10.9	3.8
HC	.1	1.0	.7	.2	.1	.1
NOX+	4.9	342.8	214.6	57.1	21.4	7.6
OIL TEMPERATURE, F	204	218	224	223	218	214
OIL PRESSURE, PSI	55	55	55	55	55	55
COOLANT TEMPERATURE, F	187	189	189	189	189	189
EXHAUST PRESSURE, IN. H2O	2.0	30.0	25.0	9.0	5.0	3.0
EXHAUST TEMPERATURE, F	1086	1388	1352	1255	1212	1179

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	98.01	99.01	100.01	101.01	102.01	103.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/25/78	9/25/78	9/25/78	9/25/78	9/25/78	9/25/78
BAROMETER, MMHG	749.6	749.6	749.6	749.6	749.6	749.6
HUMIDITY, GRAINS/LB	76	76	76	76	76	76
TEMPERATURE, F	75	77	79	79	80	79
ENGINE SPEED, RPM	3600	3600	3600	3600	3600	4300
TORQUE, FT-LB	59.2	47.0	19.7	10.6	1.3	58.2
POWER, BHP*	40.1	31.8	13.3	7.2	.9	47.1
FUEL RATE, LB/HR	18.5	15.4	9.6	7.5	5.5	24.2
IGNITION TIMING, DEG BTDC	27.0	35.0	39.0	38.0	38.0	29.0
MANIFOLD VACUUM, IN HG	5.5	7.5	14.0	17.4	20.5	5.5
THROTTLE ANGLE, DEG	35.0	31.0	19.0	15.0	11.0	36.0
INTAKE MAN. TEMP., F	73	73	84	88	90	78
CONCENTRATIONS, DRY BASIS						
CO, %	.1174	.0369	.0301	.0221	.0085	2.3434
CO2, %	13.99	12.65	12.00	12.29	12.80	13.24
O2, %	.90	2.95	3.97	3.61	2.88	.20
HC, PPMC	28	15	6	5	3	920
NOX, PPM	2235	2055	637	359	161	1923
AIR/FUEL RATIO	15.46	17.15	18.06	17.69	17.02	13.90
EMISSION RATES, G/HR						
CO	138.9	40.5	21.6	12.1	3.3	3262.2
HC	1.7	.8	.2	.1	.1	64.3
NOX+	438.0	374.2	75.7	32.6	10.4	443.5
OIL TEMPERATURE, F	221	243	238	234	228	255
OIL PRESSURE, PSI	55	55	55	55	55	55
COOLANT TEMPERATURE, F	190	190	189	189	189	190
EXHAUST PRESSURE, IN. H2O	40.0	33.0	14.0	9.0	4.0	56.0
EXHAUST TEMPERATURE, F	1530	1440	1342	1300	1256	1548

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	104.01	105.01	106.01	107.01	108.01	110.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/25/78	9/25/78	9/25/78	9/25/78	9/25/78	9/25/78
BAROMETER, MMHG	749.6	749.6	749.6	749.6	749.6	749.6
HUMIDITY, GRAINS/LB	76	76	76	76	76	76
TEMPERATURE, F	80	81	80	83	80	83
ENGINE SPEED, RPM	4300	4300	4300	4300	5000	5000
TORQUE, FT-LB	46.6	19.4	11.4	1.2	50.3	16.8
POWER, BHP*	37.7	15.7	9.2	1.0	47.3	15.8
FUEL RATE, LB/HR	20.3	11.5	10.0	6.9	28.1	13.7
IGNITION TIMING, DEG BTDC	37.0	39.0	39.0	39.0	32.0	39.0
MANIFOLD VACUUM, IN HG	8.0	13.5	15.0	19.5	7.0	13.0
THROTTLE ANGLE, DEG	32.0	23.0	20.0	14.0	33.0	26.0
INTAKE MAN. TEMP., F	78	87	92	94	78	88
CONCENTRATIONS, DRY BASIS						
CO, %	.9259	.0286	.0253	.0085	5.2037	.0226
CO2, %	14.00	11.95	12.06	12.55	11.58	11.95
O2, %	.30	3.98	3.90	3.28	.06	3.96
HC, PPMC	548	7	5	3	1738	7
NOX, PPM	2363	870	565	191	963	928
AIR/FUEL RATIO	14.62	18.09	17.99	17.38	12.57	18.08
EMISSION RATES, G/HR						
CO	1132.7	24.8	18.9	4.2	7789.9	23.4
HC	33.7	.3	.2	.1	130.6	.4
NOX+	478.9	124.7	69.8	15.6	238.9	159.2
OIL TEMPERATURE, F	264	261	252	247	276	284
OIL PRESSURE, PSI	55	55	55	55	55	55
COOLANT TEMPERATURE, F	190	190	189	188	191	190
EXHAUST PRESSURE, IN. H2O	45.0	21.0	15.0	8.0	66.0	30.0
EXHAUST TEMPERATURE, F	1551	1404	1357	1325	1500	1447

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	111.01	112.01	113.01	114.01	118.01	119.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/25/78	9/25/78	9/25/78	9/25/78	9/29/78	9/29/78
BAROMETER, MMHG	749.5	749.6	749.6	749.5	744.5	744.5
HUMIDITY, GRAINS/LB	76	76	76	76	71	71
TEMPERATURE, F	79	85	80	78	73	72
ENGINE SPEED, RPM	5000	5000	5200	2500	1500	2000
TORQUE, FT-LB	8.3	1.2	64.0	61.9	19.4	61.4
POWER, BHP*	7.8	1.1	62.6	29.1	5.5	23.2
FUEL RATE, LB/HR	10.5	8.6	37.8	12.5	3.5	9.8
IGNITION TIMING, DEG BTDC	38.5	38.0	22.0	21.0	26.0	17.0
MANIFOLD VACUUM, IN HG	17.0	18.5	2.0	3.0	16.5	2.5
THROTTLE ANGLE, DEG	21.0	18.0	71.0	38.5	7.0	36.0
INTAKE MAN. TEMP., F	92	93	78	81	84	84
CONCENTRATIONS, DRY BASIS						
CO, %	.0156	.0095	6.7376	.0744	.2414	.1636
CO2, %	12.32	12.05	10.64	11.97	12.17	11.38
O2, %	3.74	3.90	.02	3.95	3.33	4.55
HC, PPMC	3	3	1680	23	460	94
NOX, PPM	506	225	363	1829	769	1408
AIR/FUEL RATIO	17.79	17.99	11.94	18.06	17.28	18.63
EMISSION RATES, G/HR						
CO	12.0	6.1	13111.2	69.7	61.0	125.9
HC	.1	.1	164.2	1.1	5.8	3.6
NOX+	64.8	23.9	116.9	283.9	31.4	174.8
OIL TEMPERATURE, F	244	274	287	208	202	204
OIL PRESSURE, PSI	55	55	55	55	50	53
COOLANT TEMPERATURE, F	190	190	190	190	189	189
EXHAUST PRESSURE, IN. H2O	16.0	11.0	112.0	22.0	1.0	15.0
EXHAUST TEMPERATURE, F	1379	1395	1540	1318	920	1192

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	120.01	121.01	122.01	123.01	125.01	126.01
DATA SOURCE CODE	1	1	1	1	1	1
TEST DATE	9/29/78	9/29/78	9/29/78	9/29/78	9/29/78	10/ 3/78
BAROMETER, MMHG	744.5	744.5	744.5	744.5	744.5	745.0
HUMIDITY, GRAINS/LB	71	71	71	71	71	45
TEMPERATURE, F	73	82	82	84	83	79
ENGINE SPEED, RPM	2500	3000	3000	5000	5000	5000
TORQUE, FT-LB	49.5	60.0	48.0	60.3	40.2	60.3
POWER, BHP*	23.4	34.0	27.2	56.9	38.0	56.7
FUEL RATE, LB/HR	10.6	14.7	12.6	28.9	21.9	29.4
IGNITION TIMING, DEG BTDC	25.0	25.0	26.0	25.0	38.0	25.0
MANIFOLD VACUUM, IN HG	6.0	3.8	5.5	3.5	9.0	3.0
THROTTLE ANGLE, DEG	26.0	38.5	32.0	50.0	26.0	50.0
INTAKE MAN. TEMP., F	84	72	81	85	85	80
CONCENTRATIONS, DRY BASIS						
CO, %	.0980	.0481	.0596	1.0170	1.3071	.9734
CO2, %	11.42	12.30	11.31	13.91	13.75	14.17
O2, %	4.43	3.37	4.79	.33	.27	.30
HC, PPMC	19	17	9	542	559	607
NOX, PPM	1382	2181	1227	2500	2500	2600
AIR/FUEL RATIO	18.59	17.55	18.96	14.61	14.44	14.61
EMISSION RATES, G/HR						
CO	81.1	51.8	59.9	1771.4	1711.1	1701.5
HC	.8	.9	.5	47.4	36.8	53.2
NOX+	184.7	379.1	199.1	702.8	528.2	655.9
OIL TEMPERATURE, F	214	223	232	273	267	277
OIL PRESSURE, PSI	53	55	55	55	55	55
COOLANT TEMPERATURE, F	189	190	189	190	189	192
EXHAUST PRESSURE, IN. H2O	18.0	31.0	26.0	94.0	50.0	96.0
EXHAUST TEMPERATURE, F	1269	1390	1357	1648	1557	1655

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE: 1978 HONDA 98-CID
FUEL CODE: 7718

TEST NUMBER	127.01
DATA SOURCE CODE	1
TEST DATE	10/ 5/78
BAROMETER, MMHG	748.2
HUMIDITY, GRAINS/LB	45
TEMPERATURE, F	73
ENGINE SPEED, RPM	4300
TORQUE, FT-LB	77.0
POWER, BHP*	62.0
FUEL RATE, LB/HR	37.7
IGNITION TIMING, DEG BTDC	28.0
MANIFOLD VACUUM, IN HG	2.0
THROTTLE ANGLE, DEG	72.0
INTAKE MAN. TEMP., F	65
CONCENTRATIONS, DRY BASIS	
CO, %	8.4552
CO2, %	9.40
O2, %	.03
HC, PPMC	2002
NOX, PPM	591
AIR/FUEL RATIO	11.24
EMISSION RATES, G/HR	
CO	15941.6
HC	189.6
NOX+	160.6
OIL TEMPERATURE, F	252
OIL PRESSURE, PSI	55
COOLANT TEMPERATURE, F	192
EXHAUST PRESSURE, IN. H2O	95.0
EXHAUST TEMPERATURE, F	1444

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

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